



## Pre-Conference Activities

### Article: Hamming It Up on ISS



Amateur radio, also called ham radio, is a fun way to talk with astronauts. Anyone with a scanner can hear astronauts talk back to Earth. If you have a transmitter, you can talk to astronauts in space.

Before 1983, only a few people could talk to astronauts in space. Now with an amateur radio license, you can talk too. The ham radio project was the first to allow astronauts to talk with the public.

How do you talk with the astronauts? Paul Dumbacher, an engineer at Marshall Space Flight Center in Alabama, tells us how. Know when the Space Station will be over your area. Know what station the astronauts transmit on. Know what the crew's schedule is. Taking time to learn a bit of amateur radio lingo will help.

People can listen to Space Station talk from home. School groups can talk with astronauts in space. It takes time to learn ham radio lingo. It's a way to be part of history. Being able to hear the astronauts talking on the radio makes it real.

This shows how math and science are good things. It shows that addition and subtraction are good things. This shows how science matters.

***Courtesy of NASA's Space Operations Mission Directorate***

# Give Me A Call

## Teacher Sheet(s)

**Objective:** Students will explore how sound travels by conducting a range of experiments with paper cup telephones.

**Level:** K-4

**Subjects(s):** Physical Science

**Prep Time:** Less than 10 minutes

**Duration:** 40 minutes

**Materials Category:** Common Household

### National Education Standards

**Science:** Science as Inquiry, Physical Science

**Technology (ITEA):** 1b, 11b, 12a

### **Materials:**

(Per group)

- Two paper cups
- Six meters (20 feet) of fishing line, string, or waxed dental floss
- Two paper clips
- Paper and pencil

### **Pre-Lesson Instructions:**

Each group will need 6 meters (20 feet) of fishing line, string, or waxed dental floss.

The fishing line seems to work best.

Choose a quiet place for students to do this activity.

Set out the materials in a central location.

Have students pick a partner.

### **Background Information:**

None

### **Guidelines:**

Ask students, "How do you think sound travels from your mouth to their ears?"

Guide students to the answer that some type of sound vibration is moving through the air. Ask students, "How can sound vibrations move through the air?"

Sound needs a substance through which to travel. When people talk to each other, the space between them is not empty; it's filled with air. Air is a substance just as the dental floss or fishing line between the cups is a substance.

### **Answers To Questions**

8. Answers will vary. Sound will be muffled.
9. It will be difficult to hear because the sound waves will not transmit efficiently along a sagging line.
10. Answers will vary. The tighter the string, the clearer the sound will be.
11. It doesn't work because the vibrations are partly diverted by the person holding the line, weakening the signal that reaches the "receiving" paper cup.
12. They travel through the line.
13. The sound waves cause the string to vibrate, moving the air inside the cup in the same pattern that was created by the original sound.
14. The reason is that wave energy is passed from atom to atom. The closer the atoms are to each other (and the stronger the wave), the more efficiently sound can travel.
15. When the particles of a substance are densely packed, as in a solid such as string or copper wire, sound waves can generally move more quickly through them. When the particles of a substance are farther apart, as in a gas such as air, the waves take longer to travel through them.

### **Discussion/Wrap-up:**

None

### **Extensions:**

None

# Give Me A Call

## Student Sheet(s)

### Objective

To explore how sound travels by conducting a range of experiments with paper cup telephones.

### Materials

(Per Team)

- Two paper cups
- Six meters (20 feet) of fishing line, string, or waxed dental floss
- Two paper clips
- Paper and pencil

### Procedure

1. Cut the fishing line or string into roughly 6-meter (20-foot) sections.
2. Use a pencil to poke a hole in the bottom of a cup.
3. Tie one end of the string or fishing line around a paper clip.
4. The inner "loop" of the paper clip should then be inserted through the hole from the outside of the cup so that it is clipped securely to the circular bottom of the cup.
5. Repeat this process using the other end of the line and the second cup.
6. Pull the string tight between the two cups.
7. Take turns placing the cup against one ear while your partner whispers into the cup at the other end of the line.
8. You should be able to hear your partners' voice resonating in the cup against your ear. Write your observation.

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9. Step in closer to your partner, so the string is now loose (sagging). Try whispering to your partner again.



10. Test whether or not your telephones will work when the line is stretched under a closed door.



11. Have a third person hold the fishing line in the middle. Does the telephone still work?



12. How are the sound vibrations getting from one cup to the other?

13. After the vibrations get to the cup at the end of the line, what might they be doing to the bottom of the cup?

14. How does sound travel through air?

15. How you think the telephone would work if you used copper wire instead of fishing line?